Conodont Biostratigraphy of the Olentangy Shale at Camp Lazarus, Ohio

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Abstract

An investigation of the Olentangy Shale at the Camp Lazarus Boy Scout Reservation was undertaken in order to determine the conodont fauna represented there. A correlation of the section at Camp Lazarus with the type section at Delaware, Ohio, and with the international Devonian standard was effected.

Introduction

Papers by Stauffer (1938) and Ramsey (1969) and others indicate the interest generated by studies of conodont biostratigraphy of the Middle and Upper Devonian rocks of the Central Ohio area. In this paper, the author presents the results of a study of conodonts from the Olentangy Shale exposed at the Camp Lazarus Boy Scout Reservation in Delaware County, Ohio. The project was biostratigraphic in nature and was undertaken to effect a correlation of the Camp Lazarus section with type section at Delaware, Ohio and with the international Devonian conodont standard section.

Acknowledgements

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Description of Section

The Olentangy Shale is a soft, argillaceous, greenish-gray shale exposed sporadically in Ontario, Ohio and Kentucky. The type section of the formation is exposed along the Olentangy River at Delaware, Ohio. Although buried beneath glacial drift in most areas, the formation is exposed fairly well in Delaware and Franklin Counties, Ohio. (Stauffer, 1938).

The section at the Camp Lazarus Boy Scout camp is located along a West flowing unnamed creek that drains the camp area. This stream enters the Olentangy River in Sec. 4, T. 4, N., R. 19 W. (See Fig. 1). The lower part of the section is poorly exposed along the bed of the creek and a considerable thickness of channel-fill, soil and organic debris immediately overlies the thin outcrops. The basal Olentangy Shale overlies the Delaware Limestone, the uppermost bed of which is light brown, dense dolomite. The contact is sharp and marked by a platy ferruginous bed less than one inch thick. The lower seven feet of the shale is a greenish-gray highly argillaceous soft shale, well exposed only between three feet and six feet. Between seven feet and eight feet a bed of medium gray, dense limestone crops out in a bed six inches thick with a six inch layer of scattered limestone lenses above. After another foot of green shale, an eight inch bed of black, organic shale is encountered. The green shale is also found between ten feet and eighteen feet with another black shale bed four inches thick at fifteen feet and a six inch limestone at eighteen feet. The upper five feet of the section is green shale with lenses of black shale. Above the Olentangy Shale, the black Ohio shale is exposed.

Total thickness of the Olentangy is twenty-three feet. The Olentangy is quite sandy throughout, especially in the lower part, and becomes increasingly gypsiferous towards the top. The upper six feet of the formation is quite pyritic. The increasing amount of sulfur-bearing minerals found towards the top of the section is probably a weathering or ground water phenomenon caused by the proximity of gypsum and pyrite in the Ohio shale above. Microfossils, consisting primarily of conodonts, ostracodes, and tentaculites, are fairly abundant throughout the section with the exception of the lower three feet. (See Fig. 2.).

Methods

In order to maintain an adequate check on any possible faunal changes in the Olentangy, it was decided to sample the section at one-foot intervals. The author walked up the creek until the Delaware-Olentangy contact was found. This point was labeled zero feet and the author proceeded up the creek taking samples, the majority of which weighed five hundred to one thousand gms. Vertical control was established by the process of hand-leveling on a standard Spieker stadia rod with a Bruton pocket transit.

The lower three feet of the section was very difficult to sample due to a high water level in the creek. Where the shale was wet, it was extremely soft and could be dug out with a field shovel; where dryer, sampling with the hammer was necessary. All the samples were sealed in individual plastic bags, labeled with masking tape and returned to the laboratory.

Separation of conodont elements from the shale in the laboratory was fairly easy, if somewhat tedious, labor. First weighed, the damp or wet shale was then thoroughly dried by baking in an oven at one hundred twenty-five degrees centrigrade for at least four hours. Once dry, the rock was placed in labeled buckets and soaked in kerosene overnight. After kerosene soaking, the shale was covered with water in the bucket and allowed to sit for several hours. The process of water-soaking generally reduced the shale to mud and insoluble residue. The mud and residue were screened and washed and everything between twenty and one hundred-mesh sizes was saved and dried. The rest was discarded.

After drying and weighing, the residue was run through a Franz Isodynamic magnetic separator to remove any magnetic substances from the residue. Only the nonmagnetic residue was saved to be searched for conodonts. The separator saved the author considerable search time by greatly reducing the amount of insignificant material in the residue. The nonmagnetic residue of each sample was then searched for conodonts under a binocular microscope at thirty magnifications. Representatives of the various species were placed in standard micropaleontological slides, one slide per sample, to facilitate study.

Conodont Faunas Reported

Samples collected from the Olentangy Shale at the Camp Lazarus section revealed a number of different species. Attention was paid, however, only to those species which had been commonly used previously in stratigraphic studies of Devonian rocks. Representatives of several species of bar-and-blade type conodonts were thus excluded from this study.

None of the author's samples taken below the three feet level of the Olentangy section yielded conodonts. However, a sample 69SE-4 collected by W. C. Sweet during September, 1969, while conducting an undergraduate stratigraphy field trip at Camp Lazarus, contained representatives of Icriodus eslaensis and Polygnathus linguiformis which represent a fauna quite unlike that shown from samples above three feet. The exact vertical position of 69SE-4 in the Camp Lazarus section is uncertain; vertical control was established somewhat inaccurately with inexpensive hand levels. The complete dissimilarity, however, between 69SE-4 and samples taken above three feet seems to indicate that 69SE-4 must lie somewhere in the lower three feet of the section.

Samples taken above three feet indicate an unchanging conodont fauna to the top of the Olentangy. Three species of platform conodonts were identified: Polygnathus decorosus, Palmatolepis flabelliformis, and Ancyrodella buckeyensis, all first described by Stauffer (1938). Unfortunately Stauffer's paper has been largely ignored by recent students of Devonian conodonts, resulting in a profusion of names for the same species and rendering identifications needlessly difficult. Stauffer himself probably also erred. It is the supposition of this author that Stauffer's species Palmatolepis marginatus is actually only an immature form of Palmatolepis flabelliformis. After a search of the available literature, it was decided that Palmatolepis flabelliformis is probably identical with the more commonly used name Palmatolepis subrecta, first identified by Miller and Youngquist (1947).

Thus, in this paper, Palmatolepis flabelliformis is held to be the same species as Palmatolepis marginatus and Palmatolepis subrecta.

Correlations

The fauna of the upper twenty feet of the Olentangy Shale at Camp Lazarus and of the upper eighteen feet of the type section at Delaware contains Palmatolepis flabelliformis, Polygnathus decorosus, and Ancyrodella buckeyensis. Below three feet at Camp Lazarus and in the lower eighteen feet of the type section, the faunas are the same and include Icriodus eslaensis and Polygnathus linguiformis. Such a sudden change in the faunas of the two sections suggests the strong probability of an unconformity within the Olentangy Shale as shown in Fig. 3.

Ramsey (1969) also notes a possible unconformity between the base of the Olentangy and the top of the Delaware. She notes the presence of Icriodus angustus, Polygnathus angusticostatus and, rarely, Polygnathus linguiformis linguiformis. The lower Olentangy Shale contains Icriodus eslaensis, Polygnathus linguiformis linguiformis, and Polygnathus decorosus. The two assemblages are separated by a time gap according to the international Devonian standard section, to be discussed later in this paper. An unconformity between the Olentangy and Delaware is thus suggested.

In the upper Olentangy Shale, Ancyrodella buckeyensis gives the best indication of the proper correlation with the international Devonian conodont standard. Ziegler (1962 A) has worked out his theories on the phylogenetic relationships among the various species of Ancyrodella. Ancyrodella buckeyensis is shown to be a direct descendent of Ancyrodella gigas

which is restricted to the middle part of the Polygnathus asymmetricus zone of the international standard (see Fig. 4.). Ziegler also notes that Ancyrodella buckeyensis gave rise to Ancyrodella nodosa which ranges from the base of the Ancyrognathus triangularis zone to the middle of the Palmatolepis gigas zone. Palmatolepis flabelliformis, also found in the Camp Lazarus section, ranges from the upper asymmetricus to the top of the gigas zone. Polygnathus decorosus has a fairly long range and is not useful in narrowing the range any further. Due to the range of Palmatolepis subrecta, the upper Olentangy cannot be older than the middle asymmetricus zone. Due to the phylogenetic relationships of Ancyrodella buckeyensis and Ancyrodella nodosa, it is the author's suggestion that the upper Olentangy is younger than the middle asymmetricus zone and older than the Ancyrognathus triangularis zone. The upper part of the Olentangy Shale thus correlates with the upper asymmetricus zone.

The lower part of the Olentangy represented by sample 69SE-4 contained specimens of Icriodus eslaensis and Polygnathus linguiformis. The major basis for the correlation of the lower Olentangy is the assertion by Klapper et al (1970) that the range of Icriodus eslaensis is limited to strata at the age of the Tully Fm. in the North American standard Upper Devonian section in New York. The Tully Fm. is assumed to be Upper Givetian in age based on the occurrence of Icriodus eslaensis in the Polygnathus varcus zone in Spain. If Klapper et al (1970) are correct, then the lower Olentangy is Upper Givetian or uppermost Middle Devonian in age.

The unconformity between the Delaware and Olentangy is demonstrated by the faunal change between the two formations. In rocks of the age of the New York section, Polygnathus eiflius is restricted to the Cherry Valley member of the Marcellus Fm. Polygnathus angusticostatus ranges from the Moorehouse member of the Onondaga Limestone through the Cherry Valley. According to Ramsey, Polygnathus eiflius is found in the lower Delaware Limestone while Polygnathus angusticostatus is found in the upper part. The Delaware Limestone would thus seem to be of Cherry Valley age. If the lower Olentangy is indeed equivalent in age to the Tully Fm., the unconformity between the Delaware and Olentangy represents a period of time equal to that represented by the Skaneateles, Ludlowville, and Moscow formations of New York. Similar conclusions were presented by Ramsey (1969). (See Fig. 4.).

Conclusions

Conodont biostratigraphy in the Olentangy Shale and Delaware Limestone at Camp Lazarus, Ohio, provides a correlation summarized in Figures 3 and 4. The unconformity in the Olentangy Shale at three feet at Camp Lazarus is found to occur at eighteen feet in the type section. The upper twenty feet at Camp Lazarus is found to correspond with the top eighteen feet at Delaware. Correlation with the international standard section for the Middle and Upper Devonian shows the Delaware to be early Givetian in age. The lower part of the Olentangy Shale is shown to be uppermost Middle Devonian, whereas the upper part is referred to the lower Upper Devonian Upper Polygnathus asymmetricus zone.

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Index Map of the Camp Lazarus Section

Fig. 1

arrow indicates sampled area

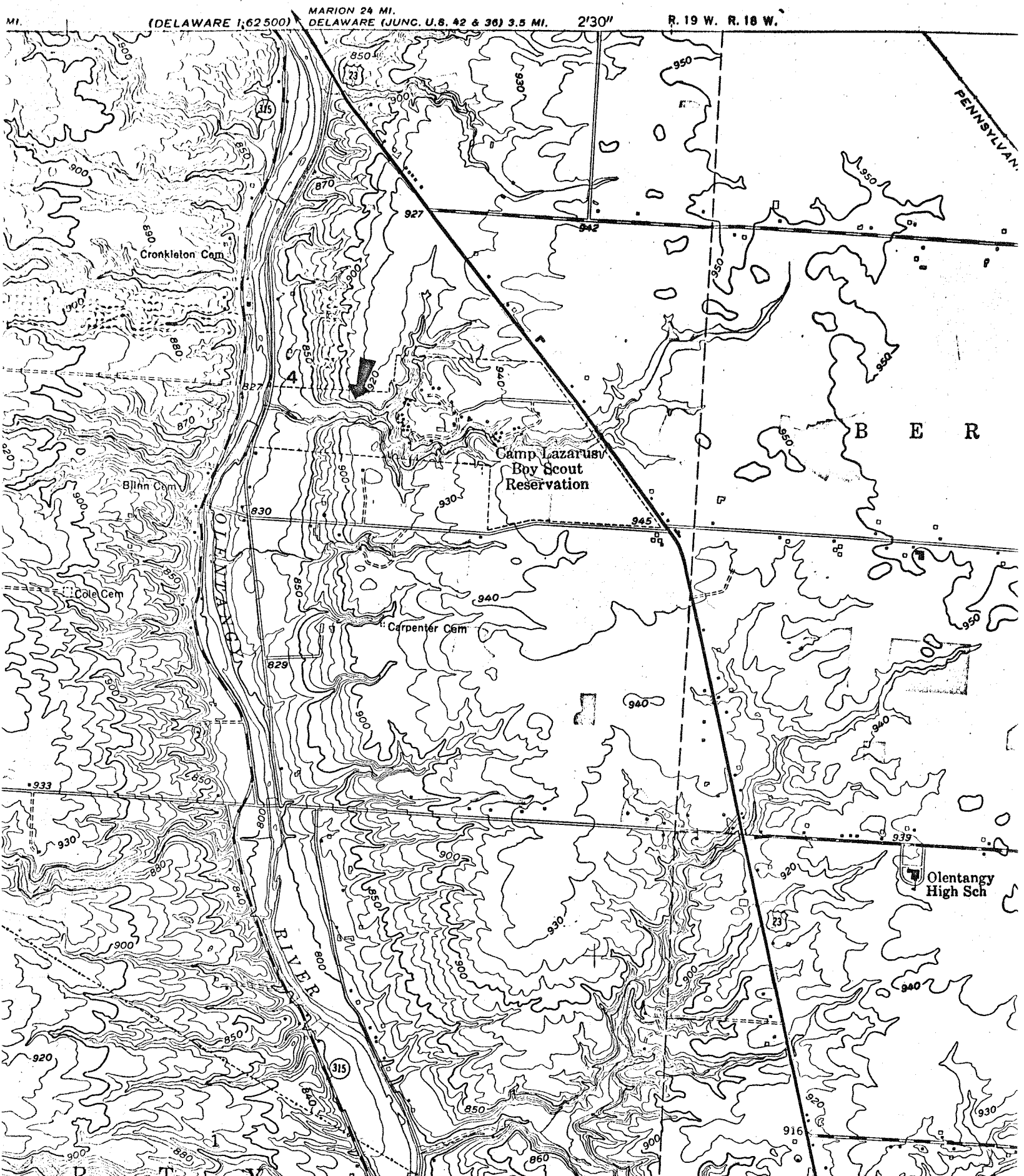

Fig. 2

Geologic Column and Conodont Fauna

Camp Lazarus

Scale: 1" = 4'

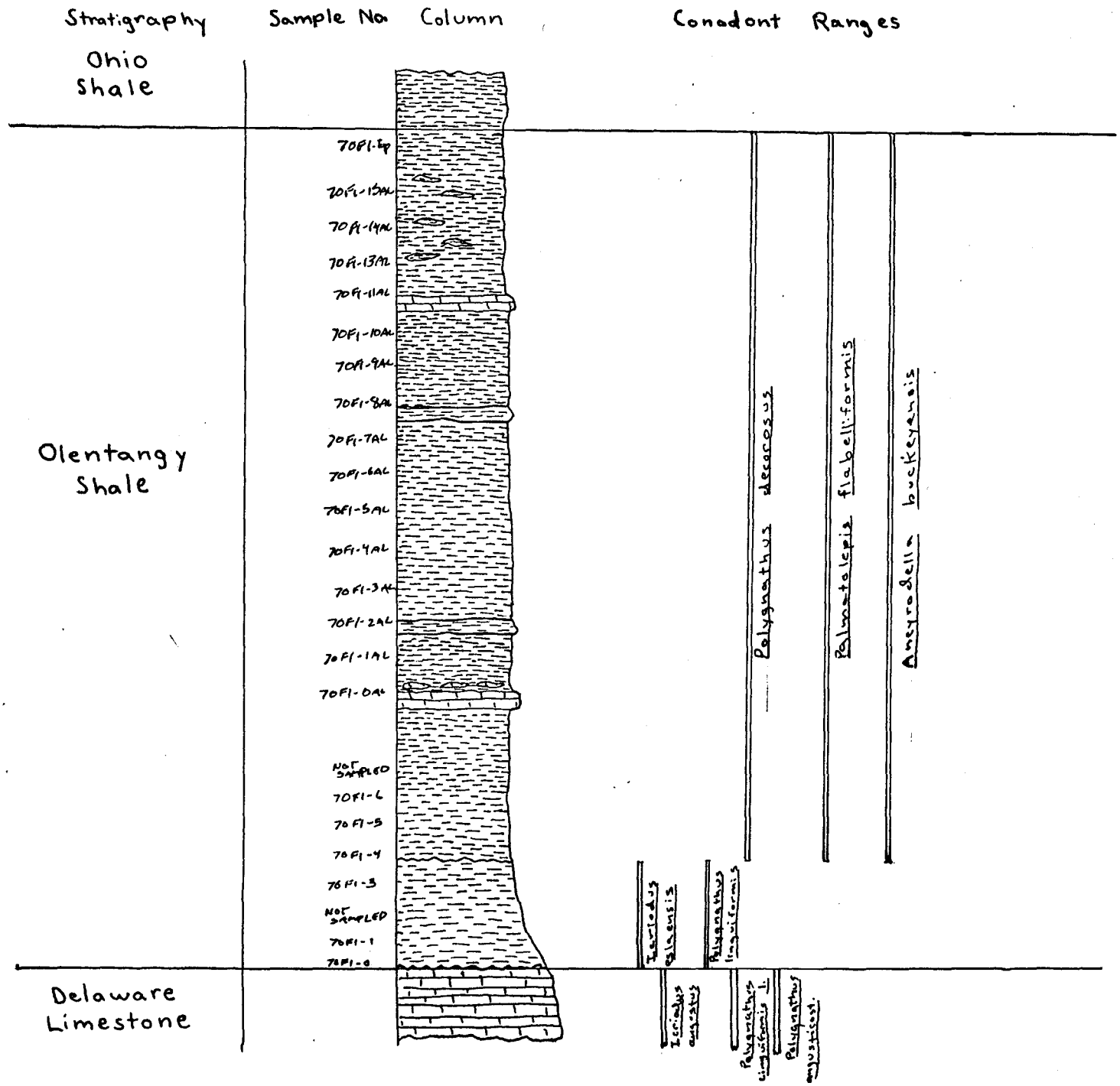

Fig. 3

Local Correlation of the Olentangy Shale

Scale: 1" = 8'

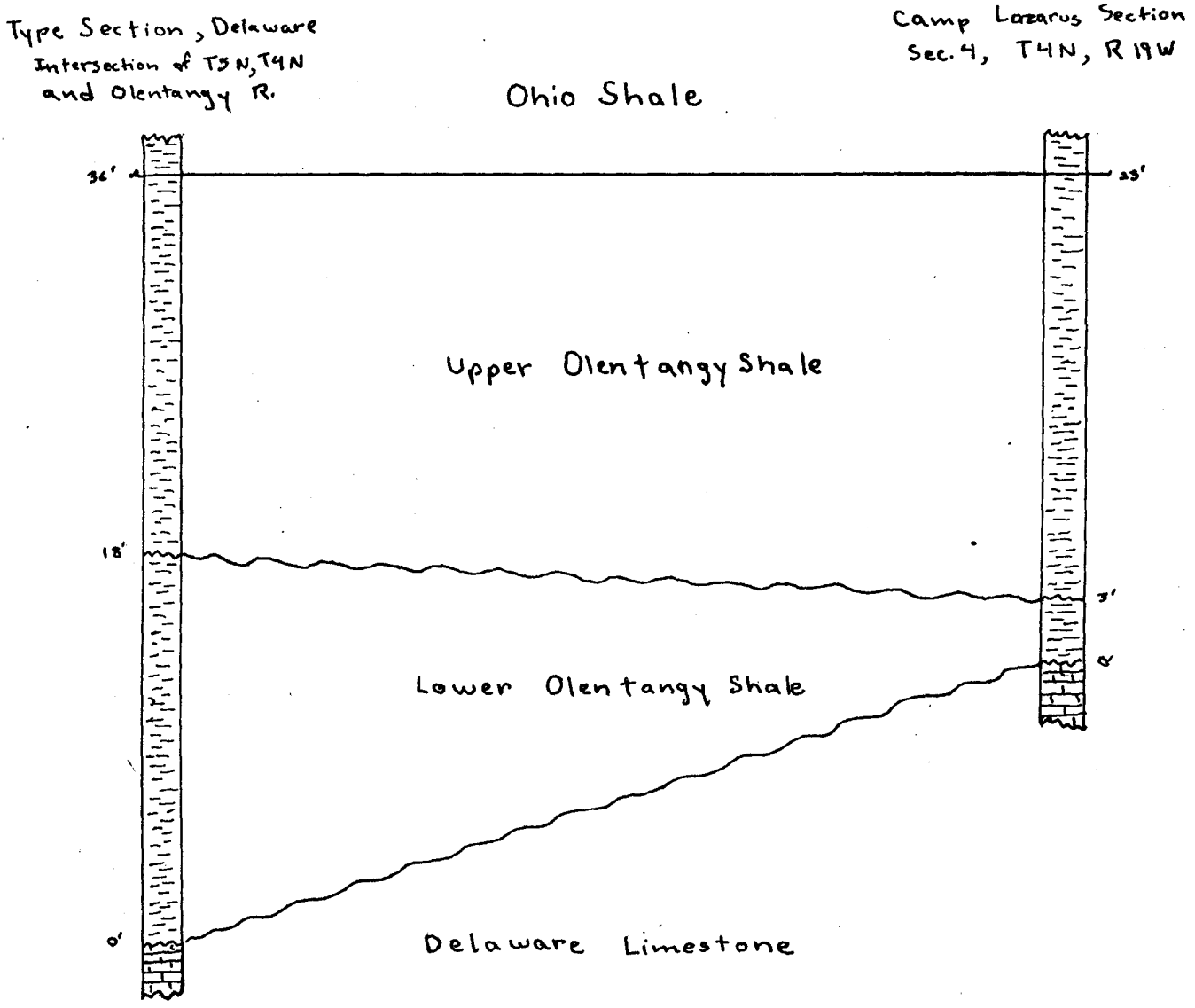

Fig. 4

International Correlation of the Olentangy Shale